QUARTERLY PERISCOPE.

FOREIGN INTELLIGENCE.

ANATOMY.

DESCRIPTIVE, SURGICAL, AND TRANSCENDENTAL.

1. M. SERRES *on some of the Laws of progressive developement in the higher animals.*—On examination of the adult skeleton, some parts of it are found to be double, such as the ribs, the bones of the extremities, certain bones of the cranium, &c., while other parts—those namely which are situated in the line of the mesial plane—are single; for example, the spinal column, the sternum, the os hyoides, the vomer, and the ethmoid, sphenoid, and occipital bones.

This mesial *unity* appears at first sight to be opposed to the lateral *duality;* but, if we trace the progress of ossification in the young animals, we at once discover that the central or mesial parts are at first double also—the corresponding or analogous portions being strictly lateral—and therefore that the whole of the osseous system obeys one common law, the law of symmetry or of lateral duality.

We find that in the earlier periods of life, there are two demi-crania, two demi-spines, two demi-sternums, &c. and moreover that the law of double formation affects equally the developement of the softer parts. Thus there are two demi-brains, two demi-wombs, and two demi-livers. Let us examine the formation of the spine a little more attentively.

In the young embryo it is found to consist of two membranous folds, quite distinct or separated from each other, the one being situated on the right side, the other on the left side of the mesial plane. I have observed them in the young chick in about twelve hours after the commencement of incubation.—There are therefore at this early period of formation two demi-spines, just as there are two parietal, and two temporal bones. In from twelve to twenty-four hours subsequently, we perceive on the two sides of these membranous folds numerous yellowish-white points, almost quadrilateral in shape, but having their angles rounded. These are the rudiments of the vertebræ. As the osseous formation advances, the two lateral surfaces gradually approach to each other, until they meet along the mesial line, and form a uniform solid case inclosing the spinal marrow. This soldering together of the lateral halves takes place in the chick from the thirteenth to the fourteenth day of incubation. The dorsal vertebræ are united a good deal earlier than the lumbar and caudal vertebræ. Similar appearances to those now described may be seen in the young human embryo. The double line of osseous points, which are to form the central part of the sacrum, are very distinctly seen in the young embryo. Of all the vertebræ, the atlas is the most tardy in being ossified. It usually remains more or less cartilaginous until the end of the first year, and at this period we observe two lateral points or nuclei, which gradually converge towards each other, to form the body of the vertebra. If the process of developement is from any cause arrested at an early period of fœtal existence, the two

lateral portions of the spinal column may remain disunited, and as it were, cleft through and through, either at one or more points, or along the whole extent of its tract. If this arrested developemeet has occurred in the bodies of the cervical vertebræ, the œsophagus may enter into the cleft vertebral canal; if, on the other hand, the sacral vertebræ are affected, the rectum will be the part engaged, and this protrusion will sometimes be so considerable as to occasion a herniary tumour outwardly. M. Lisfranc and myself have examined several cases of these anomalies. In the last mentioned sort of malformation—namely, when the rectum protrudes between the cleft sacrum outwardly on the back, we have been enabled to remedy it partially by compressing the herniary tumour, and thus causing the discharge of all the meconium, and afterwards by maintaining the reduction of the gut by means of a compress and bandage. But a more common malformation is that, where the spinal apophyses only of the vertebræ are imperfectly developed, and remain therefore disunited: the spinal marrow and its membranes are protruded through the fissure, and the disease which has been called spina bifida is induced. In some rare cases, the whole extent of the spinal column is in this imperfect state, and the vertebral canal is open throughout from the cranium to the coccyx.

These diseases illustrate and fully confirm the law of double developement of the spine; and, on the other hand, this law affords a satisfactory explanation of their occurrence.

Let it therefore be well remembered that the skeleton is formed of two analogous and similar halves; the one on the right side, the other on the left. Every person knows that the right half is somewhat more strongly developed than the left one—a phenomenon which is observable chiefly in the upper and lower extremities. This predominance is apparent even in the vertebral column; the left half of this column being rather more feeble than the right half.

This relative weakness of one side is the primary cause of incurvations of the spine, as Dr. Guerin first clearly established. In this defect of symmetry we trace the cause of the greater frequency of curvatures towards the right than towards the left side. In a hundred cases of spinal deviation, there is scarcely one, in which the spine is inclined towards the left side. The curvature to the right side does not compromise life to the same degree as that to the left side; and for this reason, that the heart and the great vessels connected with the centre of the circulation are less seriously incommoded. When the curvature is towards the left side, the central organs of circulation are necessarily more impeded in their free play, and life is therefore more seriously endangered.

This is one of the many advantages of a philosophical study of comprehensive anatomy;—an anatomy which is not limited to a mere discovery of the structure of living bodies at one period only of their existence, but which carefully and minutely attends to the multifarious progressive changes which occur from the earlier stages of their developement, to the full maturity of their growth. If an infant have its spine incline towards the right side, the chances are greatly in favour of its life being saved, even although no remedial measures are used for its relief; whereas, if the deformity is on the left side, the utmost care and attention will be necessary to prevent the existing impediment to the circulation and breathing proving fatal at, or about the period of puberty.

It rarely happens that an anatomical truth does not lead to some useful discovery in pathology. The ingenious reasonings of M. Guerin have pointed out a rational and successful treatment in many cases of spinal deformity.—Formerly surgeons were in the habit of endeavouring to rectify such cases by drawing the spine, above and below the seat of the deviation, in opposite directions. M. Guerin, on the contrary, has substituted a method which acts directly on the centre of the deformity, by inducing a curvature in a direction the reverse of that which it is intended to remedy.

We now pass to the consideration of the osteology of the cranium and chest; and in the developement and formation of these parts we shall find that the same laws operate, which, we have attempted to show, influence the growth of the vertebral column.

At first, what is the cranium? If it is, as some authors maintain, to be viewed as an expanded vertebra, or as an assemblage of vertebræ; if the encephalic cavity is nothing else than the vertebral canal dilated and "ramené sur lui-meme;" if

the encephalon itself is the mere continuation of the spinal marrow, then we should á priori infer, that the mode of formation and developement of the two bony cases will be nearly the same, or at least that it will be analogous. Let us now examine whether these predictions are confirmed by anatomical enquiries. M. Serres has pursued this subject with great ability. After having, as it were, decomposed, or resolved a vertebra into its fundamental and constituent portions, he takes each of these portions and compares them successively with the corresponding elementary bones, which enter into the formation of the cranium.

In this manner he has shown the perfect conformity in structure of the occipital bone and of an individual vertebra; and by following this analytic process, he has pointed out a similar, but certainly a much less obvious conformity, which may be traced between the anterior and the posterior divisions of the sphenoid bone, of the ethmoid bone, and even of the bones of the face, and the primary constituent portions of a vertebra. This conformity or analogy becomes less and less conspicuous, both with the cranial and with the facial bones, the farther they are distant from the cervical extremity of the spine. M. Serres admits six cranial, and two facial vertebræ. Other anatomists have differed as to the exact number of these; but the opinions of all are fundamentally the same—namely, that an unequivocal resemblance may be traced between the formation and developement of the vertebræ, and of some of the bones of the head. All the lateral portions or segments of the cranial vertebræ are greatly amplified and expanded for the purpose of enveloping the brain and the organs of sense, while the bodies or central portions (for example, the basilar part of the occipital, the body of the sphenoid, the perpendicular plate of the ethmoid and the vomer) are proportionally diminished or rudimentary. Now these bodies or central portions, when examined in the young fœtis, are, all of them, found to be double or mesially divided, just as we have already shown to be the case with the bodies of the vertebræ themselves.

The posterior part of the occipital, the two parietal, and the frontal bones, may in truth be viewed as analogous to and corresponding with the spinous processes of the vertebræ.

This analogy in the formation of the bones of the head and of the vertebræ being once established, we are provided with a key to the explanation of many of the irregularities which are occasionally met with in these bones. For example, the base of the occipital bone, and the body of the sphenoid, remain sometimes quite disunited, and a portion of the encephalon protrudes, or forms a hernia into the back of the pharynx.

If the body of the ethmoid is imperfect from an arrested developement, a cerebral hernia into the nasal fossæ takes place. This imperfect state is much more frequently observed in the occipital, parietal, and frontal bones; and hence congenital herniæ of the brain are usually seen at some part of the convex vault of the cranium.

Those who wish to know further particulars on this branch of congenital pathology, will do well to consult the writings of the St. Hilaires, father and son.

The primary duality of the spine, of the cranium, and of the face, explains the etiology of a multitude of congenital diseases. In truth, all the organs or parts of the body, which in the adult subject are found to be single, and which are situated in the mesial line, were originally double, or cleft in two in the middle, and become united, or, as it were, soldered together, at some definite period of intra-uterine life. If this law holds good in organogeny, it must be equally so in pathology, and it is manifest that the causes which, in the cases alluded to above, operate on the spine and on the cranium, may act in the same manner and degree on the chest, abdomen, and on the organs of generation.

If we examine the sternum at different stages of fœtal life, we find a beautiful illustration of this law of mesial duality. In the very young fœtus the sternum is quite cartilaginous, and then it is laterally double, or cleft along its mesial line. Gradually we observe a double row of osseous points or nuclei, which in course of time coalesce, and thus the mesial line of separation is obliterated.

Sometimes we find that there is a large cleft or aperture in the centre of the ossified sternum. This imperfection is attributable to the progressive developement of the bone having been partially, or only at one point arrested. When this cleft is considerable, the heart may be protruded through it, and thus the disease, which has been designated ectopia cordis, is induced.

In pathology, as in other sciences, well established facts always tend to explain and illustrate each other. A fact which, considered by itself, may appear to be very curious and strange, becomes, if associated and viewed along with other analogous facts, simple and of easy explanation. This is the case with the congenital disease or imperfection, the fissure of the palate—a disease for the remedying of which, the operation of staphylorapby has been contrived.

Now what is the true nature or cause of this fissure? It is in truth the result of a progressive and normal developement of the bone having been stopped or arrested at some period of fœtal life. The same holds true of hare-lip, of fissure of the alveolar process of the maxillary bones, of spina bifida, and numerous other congenital malformations. The organic lesion, in all these instances, proceeds from one and the same cause—arrested developement.

In one case of fissure of the sternum, which fell under M. Serres' notice, there was also a mesial fissure or division of the diaphragm; the aorta and œsophagus were displaced by a hernia of the intestines which had taken place through the unnatural opening. Olasner has recorded a case, somewhat similar to this one, in which the child lived to nine years of age.

In the early stages of embryotic existence, the abdomen, throughout its whole length, is quite open, and the greater part of the bowels are lodged within the sheath of the umbilical cord. It not unfrequently happens that this open state of the abdomen does not close entirely by the period of birth; and hence the origin of most cases of congenital hernia. When the aperture is large and the protrusion is considerable, the lesion is rarely curable.

Such cases are very common, and numerous examples of malformations of the abdominal parietes have been recorded by all the systematic writers on morbid anatomy. The rationale of these irregularities of formation is the same as we have already alluded to in reference to the malformations of the osseous system. The lateral halves of the abdominal parietes are at first quite apart and separated from each other; and if, therefore, the progressive and ulterior developement is arrested, the child at birth will be found to exhibit an imperfectly closed abdomen. The two halves of the central or mesial organs of the body gradually approach each other, until they coalesce; and form one continuous and uninterrupted structure. Such are a few illustrative examples of that law of symmetry, which Meckle has denominated the "lex Serriana" (in compliment, we presume, to M. Serres,) and which so satisfactorily explains so many of the congenital deviations of structure. We now proceed to investigate another topic of organogeny, which has hitherto perplexed most philosophic anatomists.

On looking at the osseous and the other organic systems of the body, we find that many of them are hollowed out into cavities, perforated with apertures for blood-vessels and nerves, and traversed with canals, which either receive and convey the fluids necessary to life, or transmit these into the surrounding peripheral parts.

Now what is the rational explanation of these formations? Let us take, for example, the vertebral column, and examine the various apertures which it exhibits for the passage of numerous blood-vessels and nerves. On the side of each vertebra, there is a semi-elliptic hollow or excavation, which, being applied to a similar hollow on the body of the next vertebra, forms an aperture for the passage of a spinal nerve and some blood-vessels. The formation of these vertebral apertures is effected in the same manner as that of all other apertures or perforations of the osseous system—namely, by the re-union of different portions of the bone during its process of developement. For example, the foramen magnum of the occipital bone is formed by the conjunction of the four pieces, of which the bone originally consisted; the superior and inferior maxillary holes of the sphenoid bone result from the coalescence of the two halves of the alæ, and the same is true of the foramina rotunda and ovalia, and also of the meatus auditorii. Such is the mode of formation of all the apertures and passages which we observe in a mature bone; the bone originally consisted of several pieces, and as these pieces approached each other in the process of developement, a cleft or vacant space was left.

The same law holds good in reference to the perforations which we find in many of the soft structures and organs of the body. The septum of the auricles is, every one knows, cleft in the fœtus. Now this septum is, like the diaphragm,

formed of two pieces developed apart from each other; the one portion descending from the upper wall of the auricle (which is originally a single sac,) and the other portion ascending from its lower wall; and, as these approach each other, a cleft or enclosed space, the foramen ovale, is left. This cleft or aperture is always proportionately larger in the young than in the advanced fœtus.

In the same manner we may explain the formation of the various apertures through the diaphragm for the passage of the vena cava, the aorta, and the œsophagus; and not only of these apertures, but also of the pupils of the eyes, and of the openings of the mouth, the anus, the vagina, &c. The margins of all these openings were at one period of embryotic life imperfect; and all these openings, without exception, were formed by the "adossement" or meeting together of two elliptic or semicircular muscles. Some of these parts or structures, which are normally open and perforated in the mature fœtus, were primarily formed of serous-looking membranes, which were quite closed through all their extent. If the portion which corresponds to the opening remains longer than the period assigned to it in the series of developements, the child is born with one or more of its passages imperforate. This malformation is not untrequent at the anus and vagina.

What has been stated in reference to the formation of the apertures in the bones and other parts of the body, may be applied to the explanation of the development of the various canals, as of the nasal, intestinal, urinary, &c.; and, in short, what is a canal, but merely a lengthened or prolonged aperture? The walls of the canal were at some period of fœtal life composed of two or more detached lateral portions, and these portions, gradually approaching each other, at length coalesced, so as to form a continuous and uninterrupted passage.

Thus the nasal canal has been formed by the meeting together and union of the superior maxillary, the vomer, and the turbinated bones. The central canal of the spinal marrow has arisen by the union, anteriorly and posteriorly, of the two lateral halves of the medulla, leaving a space between; and the intestinal canal is developed in a similar manner—by the concentric coalescence of separate lateral portions—as has been admirably described by Wolf.

The mode of formation of the urethra, also, is quite the same; and for several reasons I select this canal, to offer a few general observations on this curious subject of organogeny.

When the pelvis is still unclosed in the young embryo, the canal of the urethra is cleft throughout its whole length—the two lateral halves of the penis and of the clitoris are separated from each other, and the perineum is open along its mesial line, where the raphé is afterwards situated. These two halves of the genito-urinary organs gradually approach each other, and at length meet and coalesce about the time when the two ossa pubis become united. This coalescence takes place on the upper surface first, and afterwards on the lower. Anterior to this event, there is in fact no distinction of sexes, and all young embryos are alike.

When the union has taken place, the two branches of the clitoris and of the penis present so obvious a projection, that at this period—from the fortieth to the fiftieth day—all fœtuses appear to be males. But afterwards, as the fissure of the perineum contracts, and as the two halves of the urethra are approaching each other, a person might suppose that every fœtus was female. This second deception is manifested about the end of the second month of embryotic life.

We thus discover how it is that, at first, there is no recognisable distinction of sex; and that subsequently all fœtuses appear to be male, and then to be female, before the complete developement of the organs takes place. If, therefore, the developement of these parts is arrested at one or other of these periods, it is not surprising that a female child may at birth exhibit the appearance of the male generative organs, and, on the other, that a male child may exhibit the appearance of the female organs. This is the key to the explanation of the different sorts of hermaphrodism. The malformation of hypospadias (in which the canal of the urethra is more or less imperfectly closed) is readily explicable by what has been already stated. All male fœtuses, at one period of intra-uterine life, are effected with hypospadias, and, therefore, if the state of parts which constitutes this imperfection remains at birth, the child is born with an urethra more or less open along its lower surface. The open state or fissure of the canal may occur

either near to the glans, or in the middle, or quite nt the root of the passage in the perineum; and hence the varieties of the malformation which have been described by authors.—*Med. Chirurg. Rev.* from *Gazette des Hôpitaux.*

2. *On the varieties of the obturator artery, and the relations of these to the femoral ring.* It is highly probahle that there is greater risk of wounding the obturator artery during the operation for strangulated femornl hernia, than is usually supposed. The following remarks, therefure, by Dr. John Reid, on the varieties in the origin and cunrse of this artery, are deserving of nuention.

Mr. Guhrie states, in his essay on femoral and inguinal hernia, when speaking of the danger of wounding the obturator artery in operations for strangulated femoral hernia, "that he has been made aware of more than one accident of this nature having occurred in operations performed by some of the best anatomists and surgeons in London, and the patients subsequently bled nt intervals, until they died from hæmurrhage." Robert* mentions, that the celebrated Munsinna, in operating for strangulated femoral hernia, in a case where the obturator artery had surrounded the neck of the sac, wounded the external coat of the artery, and that the pntient died eight days after, from hæmorrhage arising from a rupture of the injured artery.

In 1831, I witnessed a somewhat similar case in the praetice of Dupuytren at the Hotel Dieu. The patient was a female about 60 years of age, who was brought into the hospital with well marked symptoms of strangulated femoral hernia. All the urgent symptoms ceased after the operation, and she seemed to be guing on well for a fortnight, when she was seized with severe diarrhœa, which soon carried her off. On dissectiou, a broad sheet of effnsed blood was observed through the *peritoneum*, evidently placed between that membrane and the *fascia transversatis* of Sir A. Cooper, extending from the lower part of the *pelvis*, up nearly to the *umbilicus*. This was found to have taken plaee from the obturator artery, which in this case had arisen from the external iliae by a trunk common to it with the epigastric, and had nearly surrounded the neck of the sac, and which, during the operation, had been completely cut aeross. Dupuytren remarked, that the blood which eseaped externally during the operation, was greater than usual, but this soon ceased. Had this woman not died from the effeets of the diarrhœa, it would never have been discovered that the obturator artery had been wounded. The extent of the hæmorrhage was in all probability diminished, by the artery having been completely cut aeross.

The most common origin of the obturator artery is from the internal iliac or some of its branches; hut in a great number of cases it is found to arise either directly, or much more commonly indirectly from the external iliac, by a tunk cummon to it with the epigastric. When it arises from the internal iliac, it is evident that it can in no way be implicated in the operation for femoral hernia, in whatever manuer it may he performed. Even when it arises from the external iliac, it is hut very rarely endangered in the ordinary methods of performing this operation, as it generally proceeds downwards and inwards, first passing along the outer or iliae side of the femoral ring; and then along part of its posterior margin, to reaeh the upper portion of the obturator *foramen*. In the rarer cases, which seem to be principally those in whieh the common trunk of the obturator and epigastric is longer than usual, the obturator takes a more circuitous course, passing along the upper margin of the femoral ring, and then nlong its inner or pubic margin. It must be evident that when n femoral hernia descends, the relative position of the nrtery to the neek of the sac, in these two cases, is very different, and, in a praetieal point of view, involves very important considerations.

We have stated that the most common, or what is considered the normal origin of this artery, is from the internal iliae, or one of its branches. The origin next in frequency is by a common trunk with the epigastric from the external iliac. More rarely it springs directly from the external iliae, and still more rarely from the femoral. Though the artery may thus arise from points placed at a considerable distance from each other, it invariahly makes its way out of the *pelvis* by the same opening, viz. the upper part of the *obturator foramen*. When it is a branch

* Journal des Progres des Sciences Medicales, Tome viii. p. 193.